Soil and Resource Report for 1080 State Highway 16, Waimauku.

Prepared By: Ian Hanmore

Prepared For: Ian Humphrey

28th February 2025

Hanmore Land Management

TABLE OF CONTENTS

1.0 INTRODUCTION

This report has been prepared at the request of the client to assess the Land Use Capability (LUC) classifications at 1080 State Highway 16, Waimauku. The New Zealand Land Resource Inventory (NZLRI) maps have classified approximately a third of the site as LUC classes 2 and 3. As such, it could potentially fall under the National Policy Statement for Highly Productive Land (NPS-HPL) and the Auckland Unitary Plan (AUP) definition for prime and elite soils.

The purpose of the report is to map the site and identify any HPL as defined by the NPS-HPL and any prime and/or elite soils, as defined by the AUP. To achieve this a site visit was carried out to map the soils and land use capability units on this area and assess them in relation to the NPS-HPL and the Unitary plan soils definitions.

This report presents the description of each of the soil types identified on the property as well as descriptions of each of the LUC units mapped. This information is then used to determine and quantify any highly productive land and any prime or elite soils present. This information is accompanied by LUC, soil and soil classification maps along with the relevant LUC unit and soil profile descriptions.

2.0 MAPPING METHOD

Two site visits were carried out on the 4th and 20th of February 2025 to evaluate and describe the soil types and the LUC units present. The property was mapped at a scale of between 1:5,000 and 1:10,000.

LUC mapping was carried out in accordance with the methods described in the 3rd Edition of the Land Use Capability Survey Handbook (Lynn et al 2009). This process involves making a land resource inventory (LRI) of the property in which soil types, soil parent materials, land slopes, erosion type and severity and land cover are recorded. Whenever any of these land features changes a new unit is made.

Specific field work activities include digging and describing soil profiles on each landform with supporting holes dug or profiles observed on bank/drain cuttings to establish soil boundaries, measuring slopes with a clinometer, and gathering any other data that may be of assistance in assessing the suitability of the land for primary production such as erosion, susceptibility of the land to flooding, winter wetness and/or cold, high temperatures, exposure to salt winds, aspect, and accessibility. This information is then used to determine the specific LUC units, as described in the LUC Classifications of the Northland Region (Harmsworth, 1996) for the area. At times when mapping at a scale finer than Harmsworth (1996) of 1:50,000, new LUC units are recorded and are noted with an * in the LUC description table.

3.0 SITE DESCRIPTION

This site is located at 1080 SH 16 and covers approximately 195ha. The site is comprised of undulating to rolling old sand dunes and flat to steep old volcanic terrain with small areas of wet alluvial flats and peaty bogs. Soil drainage varies from well drained to very poorly drained. At the time of the site visit the site was being used to graze Jersey bulls and for producing baleage. There are a number of farm and residential buildings at the site.

3.1 Soil Profiles and Descriptions

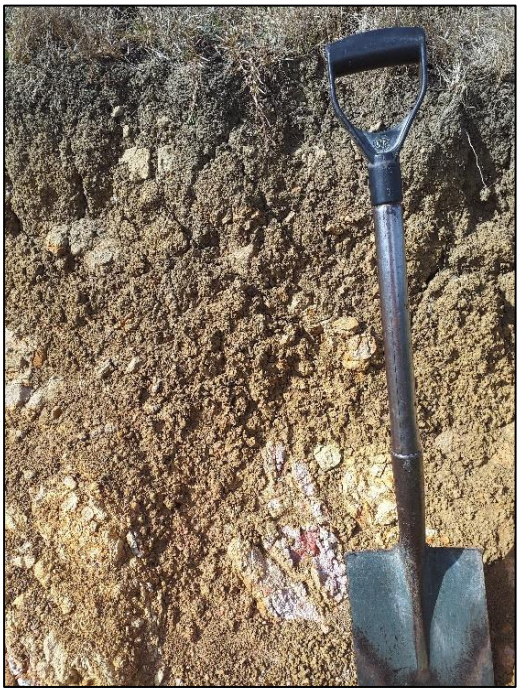
There are a number of different soils at the site which reflect the geology they have formed from. The majority of the site is dominated by strongly weathered and podzolised clay soils formed on andesitic volcanic dolerites, breccia, tuffs and agglomerates. These cover approximately two thirds of the site from east to west. The remainder of the site is dominated by moderately to strongly leached and podzolised sand soils formed on aeolian sands from the west coast. Some of which originally covered the volcanic parent material but has subsequently eroded away leaving patchy podzolised sand soils among the volcanic clays on the southwest facing slopes.

A number of other soil types have also been identified at the site. These cover small pockets around the site and are mostly alluvial and organic soils. Soils labelled as WL are raw soils typically found in a wetland/swamp that are permanently saturated and bogy and have not developed a proper soil profile.

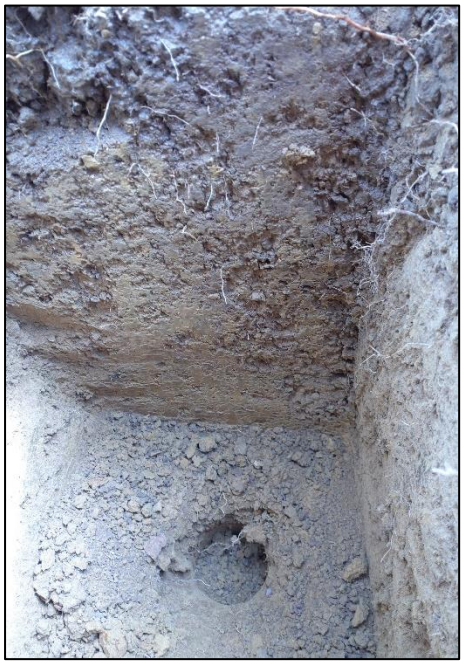
All of the soils identified across the site area are presented and described in the table below with their distribution shown on the soil map in Section 6.0 of this report.

Soil Profile	Soil Profile Description
	**Soil Name**: Red Hill sandy clay loam (RLl) **Soil classification**: Moderately to strongly leached yellow brown sands from the Pinaki suite **Parent material**: Sand **Soil description**: 0-370 mm: Friable, weakly developed, medium crumb, non-sticky, non-plastic, black (10YR 2/1) loamy sand to sandy loam. 370 -710mm: Friable, weakly developed, medium crumb, non-sticky, non-plastic, strong brown (7.5YR 5/8) sandy clay loam. **Drainage**: Well drained.

	**Soil Name:** Rangiuru clay (RU) **Soil classification:** strongly to very strongly leached brown granular loams and clays from the Te Kie suite. **Parent material:** Shattered dolerites, breccias and tuffs. **Soil description:** 0-50mm: Friable, moderately developed, 2-5mm nut, slight sticky, slightly plastic, very dark greyish brown (10yr 3/2) sandy clay loam. 50-120mm: Friable, moderately developed, 2-5mm crumb, sticky, plastic, very dark greenish grey (Gley 1 3/10Y) sandy clay 120-410mm: Very friable, moderately developed, 2-5mm crumb, very sticky, slightly plastic, dark brown (10YR 3/3) sandy loam with small pieces of yellowish red (5yr 4/6) rock. 410-800mm: Deforms under pressure breaks to 10-30mm blocks, sticky, plastic, grey (10yr 5/1 to 10yr 6/1) sandy clay loam with strong brown (7.5 yr 4/6) mottling. **Overall drainage:** Moderately to well drained.
	**Soil Name:** Tinopai sandy loam & sandy clay (TP) **Soil classification**: Moderately to strongly podsolised soils from podzolized and granular clays of the Te Kie Suite. **Parent material:** Shattered dolerites, breccias & tuffs 0-130mm: Very firm, strongly developed, 5-20mm nut to blocky, sticky, plastic dark grey (10yr 4/1) clay with rusting along root channels. 130-250mm: Very firm, sticky, plastic greyish brown (10yr 5/2 to 2.5y 5/2) clay with rusting along root channels. 250-800mm: Firm, deforms under pressure, sticky, plastic, light olive brown (2.5y 5/3) clay with abundant olive yellow (2.5y 6/8) mottling. **Overall drainage**: Poorly drained

	**Soil Name:** Cornwallis clay (CW) **Soil classification:** Strongly to very strongly leached brown granular loams and clays and associated steepland soils from the Huia suite. **Parent material:** Andesitic agglomerates and breccias. **Soil description:** 0-150mm: Friable, strongly developed, 3-10mm nut, sticky, plastic, black (10yr 2/1) clay. 150-500mm: Friable to firm, strongly developed, 2-5mm nut, sticky, plastic, dark yellowish brown (10yr3/4) clay. 500-800mm: Friable, strongly developed, 2-4mm nut, sticky, plastic, brown (7.5yr 4/4) gravelly clay. **Overall drainage:** Moderately to well drained
	**Soil Name:** Hihi clay (HI) **Soil classification:** Strongly to very strongly leached brown granular loams and clays and associated steepland soils from the Huia suite. **Parent material:** Andesitic agglomerates and breccias. **Soil description:** 0-250mm: Friable, strongly developed, 2-8mm nut, very dark grey (5y 3/1), sticky, plastic, clay 250-450mm: Friable, strongly developed, 2-10mm nut, olive grey (5y 5/2), sticky, plastic, clay. 450-850mm: Friable, strongly developed, 2-10mm nut, olive (5y 4/4) clay with brownish yellow (10yr 6/8) mottling and fragments of weathered parent material. **Overall drainage:** Imperfectly to poorly drained

	**Soil Name**: Te Kopuru sand wet phase (TEKm) **Soil classification**: Podzolised gley soils from the Pinaki suite. **Parent material**: Sand. **Soil description**: 0-120mm: Friable, moderately developed, 2-5mm nut, non-sticky, non-plastic, black (10yr 2/1) sandy loam 120-300mm: Firm breaks to single grain and 2-10mm nut, non-sticky, non-plastic, very dark grey (10yr 3/1) sand with white podzolisation 300-500mm: Friable, moderately developed, 2-5 nut, sticky, plastic, black (10 yr 2/1) sandy clay loam. **Overall drainage**: Poorly drained.
	**Soil Name:** Te Hapu fine sandy loam with a pan (TXp) **Soil classification:** Podzols from the Pinaki suite. **Parent material:** Sand. **Soil description:** 0-230mm: Very friable, weakly developed, 2-3mm nut, slightly sticky, plastic, grey (2.5y 5/1) fine sandy loam. 230-340mm: White silica 340mm: Iron pan. In some locations iron nodules have formed rather than a solid pan **Overall drainage:** Poorly drained

	**Soil Name:** Whareora clay loam (WO) **Soil classification:** Moderate to strongly leeched yellow-brown earths from the Whareora suite **Parent material:** Sedimentary alluvium **Soil description:** 0-110mm: Friable, strongly developed,2-10mm nut, dark greyish brown (2.5y 4/2) sticky, plastic, clay to clay loam. 110-500mm: Friable, strongly developed, 2-5mm nut, yellowish brown (10yr 5/4) sticky, plastic, clay. 500-900mm: Friable, sticky, plastic yellowish brown (10yr 5/4) clay with 50% yellowish brown (10yr 5/8) mottling. **Overall drainage:** Moderately well drained
	**Soil Name:** Warkworth clay and sandy clay loam (WA) **Soil classification:** Strongly leached to weakly podzolized yellow-brown earths from the Puhoi suite **Parent material:** Banded sandstone **Soil description:** 0-130mm: Compacted, deforms under pressure breaks to 10-20mm blocks, very dark greyish brown (2.5y 3/2), slightly sticky, plastic, sandy clay with a lot of rusting around plant roots. 130-400mm: Soft, deforms under pressure, massive, light olive brown (2.5y 5/6), sticky, plastic, sandy clay with strong brown (7.5yr 5/8) mottling. **Drainage:** Moderately well to imperfectly drained.

	**Soil Name:** Waipuna clay (WU) **Soil classification:** Strongly leeched to weakly podzolized yellow-brown earths from the Whareora suite **Parent material:** Alluvium **Soil description:** 0-170mm: Friable, moderately developed, 3-5mm nut, sticky, plastic, dark grey (5y 4/1) clay with rusting along root channels. 170-600mm: Very firm, strongly developed, 5-10mm nut, stcky, plastic, light olive grey (5y 6/2) clay with olive yellow (5y 6/8) mottling. 600-750mm: Massive deforms under pressure, sticky, plastic, light grey (5y 7/1) clay with yellow (2.5y 7/8) mottling. **Overall drainage:** Poorly drained
	**Soil Name:** Waipu peaty clay (YUy) **Soil classification:** Gleyed soils from the Waipu suite **Parent material:** Terrace alluvium from sedimentary rocks. **Soil description:** 0-80mm: Massive deforms under pressure, sticky, plastic, very dark greyish brown (10yr 3/2) sandy clay. 80-290mm: Friable, strongly developed, 3-10mm nut, sticky, plastic, dark greenish grey (Gley 1 4/10GY) sandy clay. 290-700mm: Massive, breaks to 10-20mm blocks, sticky, plastic, dark greenish grey (Gley 1 4/10GY) with strong brown (7.5yr 4/6) mottling. **Overall drainage:** Very poorly to poorly drained.

Soil Name: Kohumaru mottled clay (KMm)

Soil classification: Moderately to strongly leached brown granular loams and clay and related steepland soils from the Kohumaru Suit

Parent material: Alluvium mainly from doleritic and andersitic rocks

Soil description: Kohumaru soils occupy the intermediate terrace, usually 5 to 10 metres above the floodplain, in river systems in dolerite and andersitic volcanic rock catchments. While free draining around the edges of the terraces, these soils tend to be more gleyed and may even have peaty hollows towards the middle. These soils are seasonally wet and some wet all the time. They have impeded drainage and do not dry out enough in spring to allow for early cultivation.

Overall drainage: Poorly drained.

3.2 Land Use Capability Descriptions

LUC classifications categorize land into eight classes according to its long-term capability to sustain one or more productive uses.

- Classes 1-4 have arable potential with limitations to this land use moving from class one being the most versatile, multi-use land with minimal physical limitations for arable use and increasing to severe limitations under class four land. These classes are also suitable to viticulture, berry production, pastoralism, tree crops and production forestry.
- Classes 5-7 are suitable for pastoral farming and production forestry.
- Class 8 land has no productive use and is rather managed for catchment protection and conservation purposes.

The LUC units mapped on the site are presented in the table below with copies of the full unit descriptions taken from Harmsworth (1996) contained in Appendix 1. An LUC map showing the distribution of the mapped units is contained in Section 6.

Resource information	Luc unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha) Forestry site index (FSI)
							Actual	Potential		
3e 3 Gently rolling to rolling slopes on deeply weathered interbedded sandstones and mudstones with occasional massive sandstones and mudstones.		0.4	Interbedded sandstones and mudstones, massive sandstones, and mudstones	Massive sandstones and mudstones, yellow-brown earths of the Puhoi, Waiotira and Omu suites	4-15º	Pasture	Nil	Slight sheet, rill, gully. Slight to moderate sheet, rill and gully when cultivating	Root green fodder crops. Horticulture. Intensive grazing. Forestry Now have crop (maize) in rotation	Average: 13 Top: 15 Potential: 18 FSI: 29-32 **Revised** Average: 13 Top: 18 Potential: 20
3e 5 Undulating to rolling slopes on old coastal dune landforms with yellow-brown sands on unconsolidated to compact dune sands		12.1	Unconsolidated sands and gravels	Yellow-brown sands from the Pinaki suit	7-15º	Pasture	Nil	Slight sheet, rill, and gully. Slight to moderate wind, sheet and rill when cultivated	Horticulture Root and green fodder crops Pasture Forestry	Average: 13 Top: 15 Potential: 18 FSI:27-30m
3w 1 Flat to undulating valley plains and floodplains with recent soils moderate wetness limitation and occasional flooding.		0.3	Fine alluvium	Recent soils on sedimentary and volcanic alluvium.	0-7º	Pasture	Nil	Moderate streambank and deposition	Horticulture Vegetables Cereals Green fodder crops Intensive grazing Forestry	Average: 21 Top: 26 Potential: 30 FSI: 23-26 **Revised** Average: 15 Top: 20 Potential: 22

Resource information	Luc unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha) Forestry site index (FSI)
							Actual	Potential		
3s 4 Flat to undulating slopes on valley floors, swales, and sand plains between old coastal dune hills.		6.7	Unconsolidated sand	Yellow-brown sands and organic soils on aeolian sand.	0-7º	Pasture	Nil	Slight to moderate wind and sheet when cultivated.	Root green fodder crops. Horticulture. Intensive grazing. Forestry	Average: 13 Top farmer:15 Potential: 18 FSI:29-32m
4e 3 Rolling to strong rolling slopes within rolling downlands, hills and at the sides of plains and terraces on old volcanics.		See table in section 4.3 for total areas	Ancient volcanics, breccias, pyroclastics, lavas and ignimbrites, ultramafics	Brown granular loams and clays on old volcanic rocks	8-20º	Pasture	Nil	Slight sheet, rill, and gully. Moderate rill, and sheet when cultivated, slight wind when cultivated	Root and green fodder crops Pasture Forestry	Average:13 Top:15 Potential:18 FSI:29-32m **Revised** Average: 11 Top: 13 Potential:15
4e 5 Rolling and strong rolling slopes within a subdued rolling to hilly landscape on strongly weathered interbedded and occasionally massive sandstones and mudstones.		1.1	Bedded sandstone and mudstone, less extensive areas of massive sandstone and mudstone.	Yellow-brown earths on stratified and massive sandstones and mudstones	8-20º	Pasture	Slight gully	Slight to moderate sheet, soil slip, tunnel gully, earthflow, and rill. Slight to moderate rill and gully and moderate to severe sheet when cultivated.	Root and green fodder crops Intensive grazing Forestry	Average: 13 Top: 15 Potential:18 FSI: 29-32
4e 9 Rolling to strong rolling slopes on old coastal dune landforms		See table in section 4.3 for total areas	Unconsolidated to compact sands.	Yellow-brown sands from the Pinaki suit	8-20º	Pasture	Slight gully	Slight to moderate sheet, wind, and gully. Moderate sheet, wind, rill, and gully when cultivated.	Root and green fodder crops Pasture Forestry	Average: 13 Top: 15 Potential: 18 FSI:27-30m
4w 1 Flat to undulating areas on floodplains, valley plains and low terraces with severe continuing wetness or flooding limitation.		1.9	Fine alluvium.	Recent soils on sedimentary and volcanic alluvium.	0-7º	Pasture	Nil.	Moderate streambank and deposition.	Intensive grazing Root and green fodder crops. Forestry	Average: 17 Top: 20 Potential: 24 FSI: 20-23 **Revised** Average: 13 Top: 15 Potential: 18

Resource information	Luc unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha) Forestry site index (FSI)
							Actual	Potential		
4s 3 Flat to gently undulating slopes on old deeply weathered volcanic rock with low fertility and poor drainage		See table in section 4.3 for total areas	Ancient volcanics, unconsolidated clays and silts, breccias, pyroclastics, lavas, welded ignimbrites, ultramafics	Brown granular loams and clays on old volcanic rocks and alluvium	0-7°	Pasture	Nil	Slight gully, slight rill, and sheet on undulating to rolling slopes when cultivated	Intensive grazing Horticulture Green fodder crops Forestry	Average: 13 Top: 15 Potential: 18 FSI: 24-27
4s 5 Flat to undulating slopes on coastal terraces, plains and marine benches.		9.1	Unconsolidated sands and gravels	Podzols and podzolised yellow-brown earths on coastal sands	0-15°	Pasture	Nil	Slight to moderate gully and tunnel gully and sheet under pasture. Moderate sheet, wind, rill and gully when cultivated.	Intensive grazing Root and green fodder crops Forestry	Average: 13 Top: 15 Potential:18 FSI: 20-23
6e 2 Strongly rolling to moderately steep slopes forming hilly terrain on old volcanics.		See table in section 4.3 for total areas	Ancient volcanics, breccias, pyroclastics, lavas and ignimbrites, ultramafics	Brown granular loam and clay hill soils on old volcanic rocks.	16-25°	Pasture	Slight gully and sheet	Moderate to severe sheet, soil slip and earth slip. Moderate gully and debris avalanche	Pasture . Forestry	Average:7 Top farmer:8 Potential:9 FSI:30-33m **Revised** Average: 8 Top: 10 Potential: 12
6e 6 Strongly rolling to moderately steep slopes forming rounded hills on old more stable, weathered dune sands.		See table in section 4.3 for total areas	Unconsolidated to compact sands deposited by aeolian processes	Yellow-brown sands and organic soils on aeolian sand	16-25º	Pasture	Slight sheet	Moderate sheet, wind, soil slip and gully	Semi intensive to intensive grazing Forestry	Average: 11 Top: 13 Potential: 15 FSI: 26-29 **Revised** Average: 8 Top: 10 Potential: 12
6e16 Moderate to steep slopes forming hilly terrain on old volcanics.		11.2	Ancient volcanics, breccias, pyroclastics, lavas and ignimbrites, ultramafics ,	Brown granular loams and clay hill and steepland soils	21-35°	Pasture	Slight sheet and gully	Moderate to severe sheet, soil slip and earth slip. Moderate gully and debris avalanche	Pasture Forestry	Average:7 Top farmer:8 Potential:9 FSI:30-33m

Resource information	Luc unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha) Forestry site index (FSI)
							Actual	Potential		
6w 3 Flat to gently undulating land with organic soils on peat and alluvium. Includes narrow valleys and interdune swamps		5.7	Peat or peat complex with fine alluvium.	Te Kopuru sand wet phase, Parore peaty sandy loam	0-3°	Pasture Rushes	Nil	Slight to moderate deposition and streambank.	Retirement Pasture	Average: 13 Top: 15 Potential: 18 FSI:<18m Revised Average: 7 Top: 8 Potential: 9
7w 1 Low-lying, flat areas on floodplains and low terraces with water tables at or near the surface.		1.9	Alluvium	Waipu peaty clay	0-3°	Pasture Rushes Wetland plants	Nil	Slight to severe stream bank	Extensive grazing Retirement	Data not available
7w 2 Peat filled valleys, plains, and coastal swamps with water tables at or near the surface, areas frequently flooded, have continuing wetness limitation.		4.7	Peat, peat, and sand complex	Wet boggy raw soil	0-3°	Wetland	Nil	Slight to moderate wind, sheet, and deposition. Slight gully.	Retirement	Non-productive

Land use capability unit descriptions are taken from the author's field work, and the Land Use Capability Classification of the Northland Region (Harmsworth, 1996).

Revised stock carry capacities are taken from a review of Harmsworth (1996) stock carry capacities by Bob Cathcart in 2017.

4.0 SOIL CLASSIFICATIONS

4.1 Highly Productive Land

The NPS-HPL came into effect on 17th October 2022 and was updated in August 2024 with the amendments taking effect from 14th September 2024. This policy seeks to protect highly productive land for use in land-based primary production, both now and for future generations. The policy statement defines highly productive land as land that has been mapped in accordance with clause 3.4 of the NPS-HPL and is included in an operative regional policy statement as required by clause 3.5. There is an interim regime for identifying highly productive land prior to a regional policy statement containing maps of highly productive land in the region is operative. Under clause 3.5(7) of the NPS-HPL, highly productive land in the interim period includes land that is: (i) zoned general rural or rural production; and (ii) LUC 1, 2, or 3 land; but is not: (i) identified for future urban development; or (ii) subject to a Council initiated, or an adopted, notified plan change to rezone it from general rural or rural production to urban or rural lifestyle.

The following definition of LUC 1, 2, or 3 land is taken from section 1.3, page 4 of the NPS-HPL:

> *LUC 1, 2, or 3 land means land identified as Land Use Capability Class 1, 2, or 3, as mapped by the New Zealand Land Resource Inventory or by any more detailed mapping that uses the Land Use Capability classification.*

A recent Environment Court ruling (Blue Glass Limited v Dunedin City Council) concluded that during the interim period the mapping by the NZLRI is the means by which LUC classes 1-3 are defined and more detailed mapping carried out since the NPS-HPL came into effect cannot be used to redefine those classifications.

4.2 Elite and Prime Soil

The Auckland Council seeks to protect the productivity potential of elite and prime soils by regulating non-productive land uses and inappropriate subdivision. The following definitions for each classification are taken from the Auckland Unitary Plan Chapter J1 Definitions.

4.2.1 Elite soils

Land classified as Land Use Capability Class 1 (LUC1). This land is the most highly versatile and productive land in Auckland. It is:

- well-drained, friable, and has well-structured soils;
- flat or gently undulating; and
- capable of continuous cultivation.

Includes:

- LUC1 land as mapped by the New Zealand Land Resource Inventory (NZLRI);
- other lands identified as LUC1 by more detailed site mapping;
- land with other unique location or climatic features, such as the frost-free slopes of Bombay Hill;

- Bombay clay loam;
- Patumahoe clay loam;
- Patumahoe sandy clay loam; and
- Whatitiri soils.

4.2.2 Prime soils

Land identified as land use capability classes two and three (LUC2, LUC3) with slight to moderate physical limitations for arable use.

Factors contributing to this classification are:

- readily available water;
- favourable climate;
- favourable topography;
- good drainage; and
- versatile soils easily adapted to a wide range of agricultural uses

4.3 Site Classifications

The table below shows the LUC area breakdown for the proposed site as well as the percentage of highly productive land and prime and elite soil.

Mapped LUC Units	Area (ha)	HPL Classification	Prime or Elite Soil	% of total Area
3e 3	0.4	HPL	Prime	0.2
3e 5	12.1	HPL	Prime	6.2
3w 1	0.3	HPL	Prime	0.2
3s 4	6.7	HPL	Prime	3.4
4e 3	32.5	Not HPL	Not prime or elite	16.6
4e 3+4s 5	4.8	Not HPL	Not prime or elite	2.5
4e 3+6e 2	0.8	Not HPL	Not prime or elite	0.4
4e 5	1.1	Not HPL	Not prime or elite	0.6
4e 9	23.9	Not HPL	Not prime or elite	12.2
4e 9+6e 6	1.2	Not HPL	Not prime or elite	0.6
4w 1	1.9	Not HPL	Not prime or elite	1.0
4s 3	15.0	Not HPL	Not prime or elite	7.7
4s 3+4e 3	2.8	Not HPL	Not prime or elite	1.4
4s 5	9.1	Not HPL	Not prime or elite	4.6
6e 2	51.1	Not HPL	Not prime or elite	26.1
6e 2+4e 3	3.0	Not HPL	Not prime or elite	1.5
6e 6	0.7	Not HPL	Not prime or elite	0.4
6e16	11.2	Not HPL	Not prime or elite	5.7
6w 3	5.7	Not HPL	Not prime or elite	2.9
7w 1	1.9	Not HPL	Not prime or elite	1.0
7w 2	4.7	Not HPL	Not prime or elite	2.4
Unproductive	4.8	Not HPL	Not prime or elite	2.5

Total area	195.7			
Area HPL & prime soil	19.5	Total % HPL & prime soil		10.0
Total area non-HPL & non-prime or elite soil	180.2	Total % non-HPL & non prime or elite soil		90.0

4.4 NZLRI Mapping

The NZLRI is based on an LUC assessment of the whole of New Zealand and has been carried out at a scale of 1:50,000. It is intended for regional use and planning and is not meant to be used at a farm scale. The 3rd Edition of The Land Use Capability Survey Handbook (Lynn et al 2009) cautions against enlarging LUC data beyond the scale at which it was gathered as it can produce unreliable and misleading results and at time results that are nonsense.

At a scale of 1:50,000, on average one mapping observation is made every 25ha but could be a little as one every 100ha (Hewitt and Lilburne 2003, Grealish 2019). As such, it is likely that very little data has been gathered from the proposed site. For the purpose of this report, with a site covering 196ha the appropriate scale of mapping is between 1:5,000 and 1:10,000 or one to four observations per hectare (Lynn et al 2009).

Using the NZLRI for site specific information is outside of its intended purpose and outside of its parameters of reliability. At best it can only provide an indication of the possible LUC units present. The correct process for mapping soil types and LUC at a site of this size is to carry out a site survey at the correct scale by a suitably qualified person as has been done for this report.

4.5 Reclassified LUC Units

The property has been mapped by the NZLRI as LUC units 2w 1, 3e 3, 3e 5 and 4e 9. Based on the farm scale survey carried out for this report units 3e 3, 3e 5 and 4e 9 have been mapped at the site. A number of additional units have also been mapped at the site which reflect the land resources present. These additional units and the reasons for changes to the NZLRI mapped units are discussed below.

- The distribution of the three units mapped by the NZLRI that were confirmed at the site (3e 3, 3e 5 and 4e 9) have been refined due to the detailed scale of mapping and therefore have a pattern different from the NZLRI maps.
- Unit 2w 1 has not been mapped at the site as the wetness limitation due to runoff and poor soil drainage have been assessed as moderate rather than slight. As such, the area was given a LUC 3w 1 classification.
- Units 3s 4, and 6e 6 are variations of the 3e 5 and 4e 9 units. With unit 3s 4 mapped on easier slopes and unit 6e 6 on steeper slopes.

- Units 4s 3, 4e 3, 6e 2 and 6e16 have been mapped on areas of old andesite volcanic material. This underlying parent rock has been mapped by the 1:250,000 scale New Zealand Geology maps as well as the Northland soil maps but has not been recognised by the NZLRI. These four units reflect the soil types and slopes at the site.
- Unit 4e 5 is a slightly steeper version of unit 3e 3 mapped by the NZLRI and mapped during the site survey.
- Units 6w 3, 7w 1 and 7w 2 have been mapped in riparian and wetland areas and reflect the prolonged wetness at those sites and the risk of flooding. These areas are typically too small to have been identified at the scale of the NZLRI mapping.
- Unproductive areas have been mapped at the site and include infrastructure, retired areas and residential dwellings. These areas have not been given an LUC classification as they have no productive potential.

5.0 OVERALL SITE ASSESSMENT

An assessment of the site has been made based on the definition of HPL under the NPS-HPL. It is acknowledged that for technical purposes based on the Blue Grass ruling referred to in Section 4.1 of this report that approximately 63ha of the site is classified as HPL (see Figure 1 below). However, for the reasons outlined in Section 4.3 of this report the findings of this report are relevant to the productive use of the site and its potential use in a highly productive capacity. Explanations for the assessments made at the site are discussed below

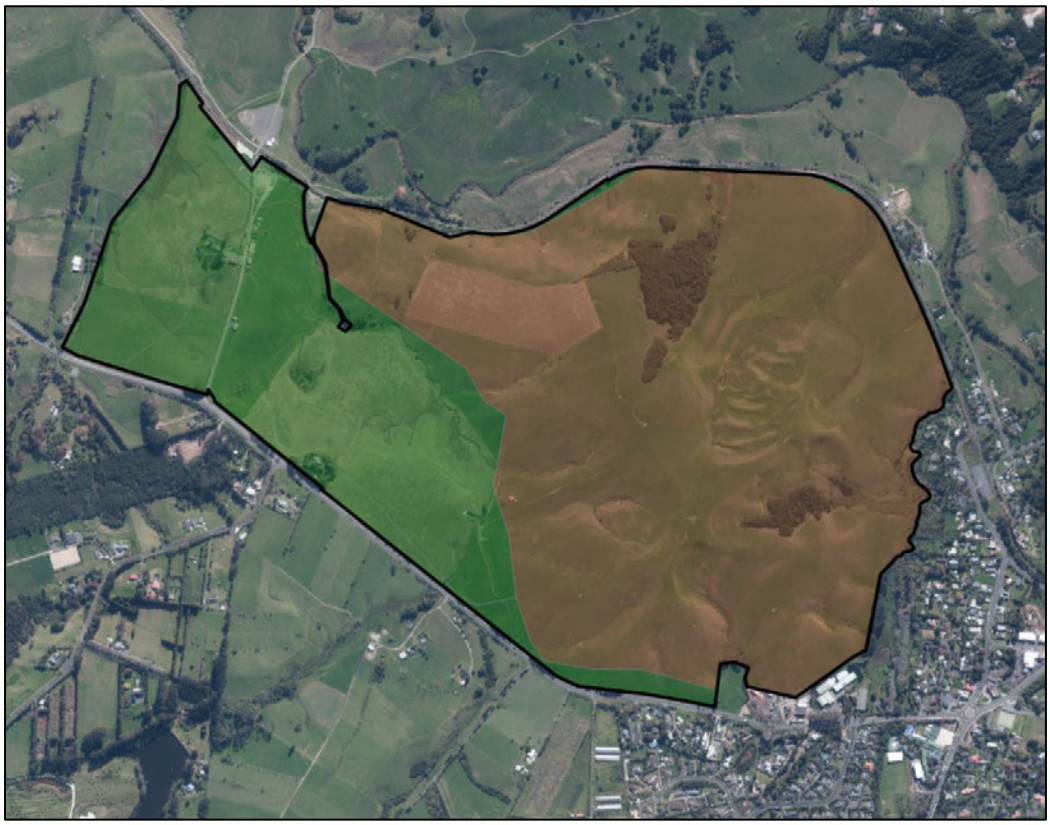


Figure 1. HPL classifications based on the NZLRI with HPL shown in green and non-HPL shown in brown.

A significant area of the site mapped by the NZLRI as LUC unit 3e 5 and therefore HPL has been reclassified due to the slope. The 3e 5 unit mapped by the NZLRI includes Red Hill sandy clay loam soils on undulating (4-7^0) slopes and undulating slopes with small areas of rolling slopes (8-15^0) (Harmsworth 1996). A significant portion of this area was found to have rolling slopes which put it into the 4e 9 unit and therefore outside of the HPL classification.

Other areas within the NZLRI HPL area have different soil types than the Red Hill soil mapped by the NZLRI and severe wetness limitations. Soils on the western boundary are very poorly drained alluvial clays which have little or no arable potential due to the severe wetness limitations due to high water tables, poor drainage, runoff from the surrounding hills and the risk of flooding.

Also spread throughout the NZLRI HPL area are small swamp/wetland areas. These have high water tables, poor drainage and permanent surface water. As such, they have no arable potential and are therefore outside of the HPL classification.

5.1 Land and Soil Classifications

Under the interim NPS-HPL all LUC units in LUC classes 1, 2 and 3 are classified as HPL. As such, the areas of LUC units 3e 3, 3e 5, 3w 1 and 3s 4, will come under this classification. These units cover 19.5ha or 10% of the site. These same LUC units meet the definition of the prime soils classification. The remaining area of the site consists of LUC classes 4 to 7 and unproductive areas and are therefore outside of the HPL classification and both the prime and elite soils categories. The HPL and prime and elite soil classifications are presented in the Soil Classifications map in Section 6. This map also shows a significant number of the land resource inventory (LRI) data acquisition points made during the survey for this report.

1080 State Highway 16 Soil Map

N

Legend

- CW - Cornwallis clay
- HI - Hihi clay
- RLI - Red Hill sandy clay loam
- RU - Rangioro clay
- RU+TXp - Rangiuru clay + Te Hapua sand with a pan
- TEKm+PZ - Te Kopuru sand wet phase + Parore peaty sandy loam
- TP - Tinopai sandy loam
- TXp - Te Hapua sand with a pan
- WA - Warkworth clay
- WO - Whareora clay loam
- WU - Waipuna clay
- YUy - Waipu peaty clay
- KMm - Kohumaru mottled clay
- WL - Raw wetland soil
- Unproductive

Hanmore Land Management

Property Location: 1080 SH16, Waimauku, NZ. Date: 28th February 2025. Scale 1:7,000@A3. Map Created By: Hanmore Land Management, info@hlm.co.nz, Ph: 021 201 3441.

1080 State Highway 16 Land Use Capability Classifications

N

Legend

- 3e 3
- 3e 5
- 3s 4
- 3w 1
- 4e 3
- 4e 3+4s 5
- 4e 3+6e 2
- 4e 5
- 4e 9
- 4e 9+6e 6
- 4s 3
- 4s 3+4e 3
- 4s 5
- 4w 1
- 6e 2
- 6e 2+4e 3
- 6e 6
- 6e16
- 6w 3
- 7w 1
- 7w 2
- Unproductive

Hanmore Land Management

1080 State Highway 16 Soil Classifications

N

Legend

- Not highly productive land, not prime or elite soil
- Highly productive land, prime soil
- Land resource inventory data point

Hanmore Land Management

7.0 APPENDICES

7.1 Appendix 1 – LUC units used in this report.

LUC unit:		**IIIe3** (19 935 ha)
LUC suite:		4. Sedimentary rock terrain excluding greywacke:
LUC subsuite:		4a. Interbedded and massive sandstone and mudstone: (LUC units IIIe3, IVe5, VIe1, VIe8, VIIe4)
Description:		Gently rolling to rolling slopes on deeply weathered interbedded sandstones and mudstones with occasional massive sandstones and mudstones. Sandstones and mudstones sometimes partially veneered by reworked rhyolitic tephra and Quaternary-aged unconsolidated clays and silts. Soils are yellow-brown earths, and weakly podzolised yellow-brown earths. Moderate limitations for arable use. Moderate potential for sheet, rill and gully when cultivated.
Type location:		Q09/450209 Warkworth, West Coast Road
Altitudinal range:		0–400 m
Slope:		Undulating to rolling (B+C, C+B, C), 4–15°
Landform:		Gently rolling, occasionally undulating surfaces on downlands, footslopes of hills, steeper components of undulating terrace surfaces, sides of terraces.
Rock type:		Interbedded sandstones and mudstones (Sb, Mb). Massive sandstone (Sm). Massive mudstone (Mm).
Soils:		Yellow-brown earths on stratified and massive sandstones and mudstones. Yellow-brown earths of the Puhoi suite (WA, AY, AYf, MU, OU), Waiotira suite (YC, YCr, YCe, RP, RPa, PV) and Omu suite (MAr, MA, AP).
Erosion:	*Present:*	Negligible (0) to slight (1) sheet (Sh) and rill (R).
	Potential:	Slight (1) sheet (Sh), rill (R), and gully (G). Moderate (2) rill (R), sheet (Sh), and gully (G) when cultivated
Vegetation:		Improved pasture (gI), semi-improved pasture (gS), Gorse (sG), root and green fodder crops (cR), grapes and berryfruit (cG).
Annual rainfall range:		1200–1600 mm
Land use:	*Present:*	Grazing – Intensive incl. dairying – Present average carrying capacity (s.u./ha) = 13 – Top farmer carrying capacity (s.u./ha) = 15 Cropping – Root and green fodder crops. Horticulture. Viticulture. Berryfruit.
	Potential:	Cropping – Root and green fodder crops, limited horticulture, viticulture Grazing – Intensive – Attainable physical potential carrying capacity (s.u./ha) = 18 Forestry – Production – site index for *Pinus radiata* = 29–32
Soil conservation management:		– Contour cultivation and minimum tillage practices recommended when cultivating. – Avoid structural degradation of soils under intensive, regular cultivation. – Control runoff using appropriate techniques such as grassed waterways and diversion banks. – Shelterbelts recommended for pastoral and horticultural land use. May be useful for micro-climate control, for reducing wind speed and wind erosion. – Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking). – Seasonal irrigation may be required in some areas, particularly under horticultural land use.

LUC unit: IIIe5 (6598 ha)

LUC suite: 1. Coastal sand country

LUC subsuite: 1b. Old stable sand dunes on unconsolidated to compact sands: (LUC units IIIe5, IIIs4, IVe9, VIe6, VIIe9)

Description: Undulating to rolling slopes on old coastal dune landforms with yellow-brown sands on unconsolidated to compact dunesands i.e. aeolian sands. Potential for slight to moderate sheet, rill and wind erosion when cultivated. Soils moderately deep and well drained to somewhat excessively drained.

Type location: Q09/120419 Pouto Road

Altitudinal range: 0–200 m

Slope: Undulating to rolling (B+C), 7–15°

Landform: Interdune, swales, elevated terrace surfaces on dunesands.

Rock type: Unconsolidated sands and gravels (Us).

Soils: Yellow-brown sands on aeolian sands. Moderately weathered, moderately to strongly leached yellow-brown sands of Pinaki suite (HO, RLa, RL, RLl).

Erosion:
Present: Negligible (0) to slight (1) sheet (Sh), wind (W) and gully (G)
Potential: Slight (1) sheet (Sh), rill (R) and gully (G). Slight (1) to moderate (2) wind (W), sheet (Sh), and rill (R) when cultivated

Vegetation: Improved pasture (gI), semi-improved pasture (gS), manuka, kanuka (sM).

Annual rainfall range: 1000–1400 mm

Land use:

Present:	Grazing	–	Intensive
		–	Present average carryng capacity (s.u./ha) = 13
		–	Top farmer carrying capacity (s.u./ha) = 15
	Cropping	–	Horticulture
Potential:	Cropping	–	Horticulture. Root and green fodder crops. Cereals.
	Grazing	–	Intensive
		–	Attainable physical potential carrying capacity (s.u./ha) = 18
	Forestry	–	Production – site index for *Pinus radiata* = 27–30

Soil conservation management:
- When cultivating, contour cultivation and minimum tillage practices recommended. Need to minimise surficial erosion.
- Avoid structural degradation of soils under intensive, regular cultivation.
- Shelterbelts essential for minimising wind and sheet erosion under pastoral and horticultural land use. Cultivated areas should not be left exposed to sheet and wind erosion and unprotected for long periods. Shelterbelts may also be useful for maintaining soil moisture levels.
- Maintain complete vegetative cover and good pasture quality.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking, particularly near gates, fencelines, and around troughs).
- Irrigation important, particularly for horticulture.

Comments: Moderate limitations for arable use, largely due to potential for erosion when cultivated; limitations due to soil characteristics and seasonal soil moisture deficit.

LUC unit: IIIw1 (30 252 ha)

LUC suite: 2. Alluvial and estuarine plains and low terraces

LUC subsuite: 2a. Well drained floodplains and low terraces: (LUC units IIw1, IIIw1)

Description: Flat to undulating floodplains, valley plains and low to intermediate terraces with recent soils, and occasional yellow-brown earths and brown granular loams and clays, on sedimentary and volcanic alluvium. Runoff from surrounding hills and moderately high watertable increase the wetness limitation. Areas may be prone to occasional flooding, and slight to moderate streambank erosion and deposition. IIIw1 occurs throughout region.

Type location: P05/960425 Ngapipito Road near Moerewa

Altitudinal range: 0–100 m

Slope: Flat to undulating (A, B), 0–7°

Landform: Floodplains, valleys plains, low terraces.

Rock type: Fine alluvium (Af).

Soils: Recent soils on sedimentary and volcanic alluvium. Recent soils of Whareora suite (WF, WFm, WFa) and Kohumaru suite (MF, MFm). Less extensive areas of moderately to strongly leached yellow-brown earths of Whareora suite (WOa, WO), and moderately to strongly leached brown granular loams and clays (KM, KMm).

Erosion: *Present:* Negligible (0) to slight (1) streambank (Sb) and deposition (D)
Potential: Slight (1) to moderate (2) streambank (Sb). Slight (1) to moderate (2) deposition (D)

Vegetation: Improved pasture (gI), semi-improved pasture (gS), manuka, kanuka (sM), podocarp forest (fP), rushes, sedges (hR).

Annual rainfall range: 1200–1600 mm

Land use:

Present:

Grazing – Intensive
– Present average carrying capacity (s.u./ha) = 21
– Top farmer carrying capacity (s.u./ha) = 26
Cropping – Root and green fodder crops. Vegetables. Cereals. Horticulture.

Potential:

Grazing – Intensive
– Attainable physical potential carrying capacity (s.u./ha) = 30
Cropping – Root and green fodder crops. Cereals. Horticulture. Vegetables.
Forestry – Production – site index for *Pinus radiata* = 23–26

Soil conservation management:

- Has potential for occasional flooding and greater flood risk than on IIw1. Suitable flood protection should be carefully planned and management should be considered over broader catchment area.
- Streambank protection may be required and stopbanks are recommended in some areas. Occasional flooding (deposition and erosion) may occur on land not protected by stopbanks. Erosion can be locally severe and difficult and expensive to repair or control.

- Drainage recommended, particularly for more intensive pastoral, cropping, and horticultural subdivision. Maintain condition of drains. Maintain clearance of vegetation within stream and river channels.
- Shelterbelts should be considered for watertable control or micro-climatic control.

Comments: Flood risk slightly higher than on IIw1. Because of increased flooding risk, vegetables and horticultural crops should be grown on intermediate to high terraces, or in flood-protected areas. Has moderate wetness limitation for arable use.

LUC unit: IIIs4 (5986 ha)

LUC suite: 1. Coastal sand country

LUC subsuite: 1b. Old stable sand dunes on unconsolidated to compact sands: (LUC units IIIe5, IIIs4, IVe9, VIe6, VIIe9)

Description: Flat to undulating slopes on valley floors, swales, and sandplains, between old coastal dune hills (interdune areas). Soils well drained to somewhat excessively drained yellow-brown sands often associated with poorly drained organic soils. Yellow-brown earths also occasionally recorded. Yellow-brown sands are subject to seasonal soil moisture deficiencies. Has moderate soils limitation for arable use.

Type location: Q10/303086 South Head Road

Altitudinal range: 0–200 m

Slope: Flat to undulating (A+B), 0–7°

Landform: Interdune areas, sandplains, valley floors filled with aeolian and alluvial sands, silts and occasional peat.

Rock type: Unconsolidated sands (Us).

Soils: Yellow-brown sands and organic soils on aeolian sand. Moderately weathered, moderately to strongly leached yellow-brown sands of Pinaki suite (HO, RLa, RL, RLl) and weakly to moderately podzolised yellow-brown earths of Pinaki suite (TT), commonly associated with smaller areas of organic soils of Ruakaka suite (PZ, OT, RK, RKu, RKd, RKv, RKl).

Erosion: *Present:* Negligible (0) to slight (1) wind (W) and sheet (Sh)
Potential: Slight (1) to moderate (2) wind (W) and sheet (Sh) when cultivated

Vegetation: Improved pasture (gl), rushes, sedges (hR).

Annual rainfall range: 1000–1400 mm

Land use:

Present:	Grazing	–	Intensive
		–	Present average carrying capacity (s.u./ha) = 13
		–	Top farmer carrying capacity (s.u./ha) = 15
	Cropping	–	Root and green fodder crops. Horticulture.
Potential:	Grazing	–	Intensive
		–	Attainable physical potential carrying capacity (s.u./ha) = 18
	Cropping	–	Root and green fodder crops. Horticulture.
	Forestry	–	Production – site index for *Pinus radiata* = 23–26

Soil conservation management:

- Contour cultivation and minimum-tillage practices recommended when cultivating.
- Avoid structural degradation of soils under intense, regular cultivation.
- Shelterbelts essential for minimising wind and sheet erosion. Under horticultural use, shelter essential for micro-climatic control and maintaining soil moisture levels.
- Maintain complete vegetative cover and good pasture quality.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking).

Comments: Well drained yellow-brown sands with weak structures, prone to seasonal soil moisture deficit. Require irrigation for arable use. Where clay contents/ organic contents are higher, soils generally have improved structure and higher fertility.

LUC unit: IVe3 (35 124 ha)

LUC suite: 7. Old volcanic terrain

LUC subsuite: 7a. Landforms on old stable basalt–andesite volcanics with brown granular loams and clays:
(LUC units IVe3, IVs3, Vc2, VIe2, VIe16, VIc1, VIIe1)

Description: Rolling to strongly rolling slopes typically below ~600 m a.s.l., within rolling downlands, hills, and at sides of plains and terraces, on old 'basic' volcanics (e.g. dolerite, andesite, basalt) including ancient volcanics (e.g. Tangihua volcanics) and volcanic breccia. Includes some areas on older volcanic alluvium. Soils brown granular loams and clays which may be affected by moisture deficiencies particularly during summer months. Potential for moderate to severe sheet, rill, wind and gully erosion when cultivated.

Type location: 004/631889 Mangonui area

Altitudinal range: 0–600 m

Slope: Rolling to strongly rolling (C, C+D), 8–20°

Landform: Rolling to strongly rolling terrain. Downlands, sides of plains, terraces. Rolling land on plateau surfaces.

Rock type: Lavas (Vo), Indurated volcanic breccias (Vb), indurated fine-grained pyroclastics (Tb), ancient volcanics (In), ultramafics (Um).

Soils: Brown granular loams and clays on old volcanics. Weakly to strongly leached brown granular loams and clays of Te Kie suite (YN, MN, RU, RUr, AW, TU, AK), Huia suite (YT, PA, DV, CW, HI, HIg, HU, BM), Katui suite (YP, WT, TO, AR, KT), Kohumaru suite (PCr, PC, PCm, PLy, PL).
Parent materials include shattered dolerites, breccias and tuffs, andesitic agglomerates, and breccias and andesitic flows.

Erosion:
Present: Negligible (0) to slight (1) soil slip (Ss), sheet (Sh), wind (W), rill (R), gully (G) and earthflow (Ef)
Potential: Slight (1) to moderate (2) soil slip (Ss), sheet (Sh), wind (W), rill (R), gully (G) and earthflow (Ef). Moderate (2) to severe (3) sheet (Sh), rill (R), wind (W) and gully (G) when cultivated

Vegetation: Improved pasture (gI), lowland podocarp–broadleaved forest (fO), manuka, kanuka (sM).

Annual rainfall range: 1400–1800 mm

Land use:
Present:
Grazing – Intensive to semi-intensive
– Present average carrying capacity (s.u./ha) = 13
– Top farmer carrying capacity (s.u./ha) = 15
Potential:
Grazing – Intensive
– Attainable physical potential carrying capacity (s.u./ha) = 18
Cropping – Root and green fodder crops
Forestry – Production – site index for *Pinus radiata* = 29–32

Soil conservation management:
- Contour cultivation and minimum-tillage practices recommended when cultivating. Need to minimise surficial erosion.
- Control runoff using appropriate techniques such as grassed waterways. Avoid sheet and rill erosion by planning runoff interception zones.

- Shelterbelts are recommended for pastoral, cropping and horticultural land use. Useful for micro-climatic control, reducing wind speeds and minimising wind erosion and maintaining soil moisture levels.
- Seasonal irrigation may be required, particularly under horticultural land uses.
- Maintain good-quality pasture cover.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking, tracking near fencelines, troughs). Bare ground difficult to revegetate on soils in this unit.

Comments: Soils generally well drained. Topsoils have strongly developed granular, nutty structures, hold little moisture and are liable to sheet erosion. Establishment and maintenance of pastures may be difficult in some areas. Fixation of phosphorus less than in brown loams but greater than on the yellow-brown earths.

LUC unit: IVe5 (58 507 ha)

LUC suite: 4. Sedimentary rock terrain excluding greywacke

LUC subsuite: 4a. Interbedded and massive sandstone and mudstone: (LUC units IIIe3, IVe5, VIe1, VIe8, VIIe4)

Description: Rolling and strongly rolling slopes within subdued rolling to hilly landscape e.g. lower hillslopes, downlands on strongly weathered interbedded and occasionally massive sandstones and mudstones. Soils typically weakly to moderately podzolised yellow-brown earths. Excludes land on limestone and greywacke. Potential for moderate to severe sheet, rill, and gully erosion when cultivated. Usually mapped in association with IIIe3 and VIe1, throughout the region.

Type location: R09/622334 Warkworth Leigh Road

Altitudinal range: 0–400 m

Slope: Rolling to strongly rolling (C, C+D), 8–20°

Landform: Rolling to strongly rolling terrain. Downlands.

Rock type: Bedded sandstone (Sb), bedded mudstone (Mb), less extensive areas of massive sandstone (Sm) and massive mudstone (Mm) are also recorded.

Soils: Yellow-brown earths on stratified and massive sandstones and mudstones. Weakly to strongly leached and weakly to moderately podzolised yellow-brown earths of Puhoi suite (WA, AY, AYf, MV, OU), Waiotira suite (YC, YCr, YCe, RP, RPa, PV) and Omu suite (MAr, MA, AP).

Erosion:
Present: Negligible (0) to slight (1) sheet (Sh), rill (R), soil slip (Ss), tunnel gully (T), gully (G) and earthflow (Ef). Slight to moderate terracette creep
Potential: Slight (1) to moderate (2) sheet (Sh), soil slip (Ss), tunnel gully (T), earthflow (Ef) and rill (R). Slightly (1) to moderate (2) rill (R) and gully (G) and moderate (2) to severe (3) sheet (Sh) when cultivated

Vegetation: Improved vegetation (gI), manuka, kanuka (sM), gorse (sG). Exotic conifer forest (fF).

Annual rainfall range: 1200- 1600 mm

Land use:
Present:
Grazing – Intensive to semi-intensive incl. dairying
– Present average carrying capacity (s.u./ha) = 13
– Top farmer carrying capacity (s.u./ha) = 15
Forestry – Production – exotic spp.
Reversion to scrub
Potential:
Grazing – Intensive
– Attainable physical potential carrying capacity (s.u./ha) = 18
Cropping – Root and green fodder crops. Horticulture.
Forestry – Production – site index for *Pinus radiata* = 29–32

Soil conservation management:
- Contour cultivation and minimum-tillage practices recommended when cultivating.
- Avoid structural degradation of soils under intensive, continuous cultivation.
- Runoff should be channelled away from steeper slopes. Control runoff using appropriate techniques (e.g. grassed waterways, diversion banks).

- Maintain good-quality pasture cover.
- Space plant trees in erosion-prone areas (e.g. mass movements). Pair plant trees in gullies.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking, tracking along fencelines, gates, around troughs).
- Shelterbelts may be useful in regulating soil moisture levels.
- Seasonal irrigation may be required for some crops.

Comments: Heavy soils, but support excellent pastures. Require light to moderate applications of phosphate and lime.

LUC unit: IVe9 (8619 ha)

LUC suite: 1. Coastal sand country

LUC subsuite: 1b. Old stable sand dunes on unconsolidated to compact sands: (LUC units IIIe5, IIIs4, IVe9, VIe6, VIIe9)

Description: Rolling to strongly rolling slopes on old (Pleistocene) coastal dune landforms, e.g. interdune valleys and dune hills. Formed on unconsolidated to compact dunesands i.e. aeolian sands. Typical soils are yellow-brown sands. Potential for moderate sheet, wind, rill and gully when cultivated.

Type location: P08/920660 Red Hill/Te Maire Road

Altitudinal range: 0–200 m

Slope: Rolling to strongly rolling (C, C+D), 8–20°

Landform: Rolling to strongly rolling older duneforms.

Rock type: Unconsolidated sands (Us). Strongly weathered unconsolidated to compact sands.

Soils: Yellow-brown sands on aeolian sand. Moderately weathered to strongly leached yellow-brown sands of Pinaki suite (HO, RLa, RL, RLl, HOH, RLaH, RLH, RLlH).

Erosion:
Present: Slight (1) to moderate (2) sheet (Sh) and wind (W). Negligible (0) to slight (1) gully (G)
Potential: Slight (1) to moderate (2) sheet (Sh), wind (W) and gully (G). Moderate (2) sheet (Sh), wind (W), rill (R) and gully (G). when cultivated

Vegetation: Improved pasture (gI), semi-improved pasture (gS), manuka, kanuka (sM), heath (sH), coastal scrub (SO).

Annual rainfall range: 1000–1400 mm

Land use:

Present:	Grazing	–	Intensive to semi-intensive
		–	Present average carrying capacity (s.u./ha) = 13
		–	Top farmer carrying capacity (s.u./ha) = 15
Potential:	Grazing	–	Intensive
		–	Attainable physical potential carrying capacity (s.u./ha) = 18
	Cropping	–	Root and green fodder crops
	Forestry	–	Production – site index for *Pinus radiata* = 27–30

Soil conservation management:
- When cultivating, contour cultivation and minimum-tillage practices essential.
- Shelterbelts required on this type of land for minimising wind and sheet erosion, under pastoral and horticultural land use. Cultivated areas should not be left exposed and unprotected for long periods (e.g. exposed to wind erosion). Shelterbelts may be useful in regulating soil moisture levels.
- Maintain complete vegetative cover and good pasture quality.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking, particularly near gates, fencelines and around troughs).
- Irrigation is important in some areas, particularly for horticulture.

Comments: Soils are well drained to somewhat excessively drained and subject to seasonal soil moisture deficiencies. With regular topdressing of phosphate and potash the Houhora and Red Hill soils give excellent pastures. Lime may not be required on soils.

LUC unit: IVw1 (35 423 ha)

LUC suite: 2. Alluvial and estuarine plains and low terraces

LUC subsuite: 2c. Poorly drained floodplains and low terraces: (LUC units IVw1, VIw1, VIIw1)

Description: Flat to gently undulating areas on floodplains, valleyplains and low terraces on alluvium, with continuing severe wetness or flooding limitation to arable use. Severe limitations to cropping because of runoff from adjacent hills, flooding of streams and high watertables. Potential for moderate streambank erosion and deposition. Recent soils on alluvium characteristic of this unit. Weakly to strongly leached yellow-brown earths and brown granular loams and clays with severe wetness limitations recorded on higher terraces. Waipuna clay on higher terraces included because of continuing wetness due to poor internal drainage of soils. Areas assessed as requiring on-farm drainage.

Type location: Q06/pt R06/217305

Altitudinal range: 0–100 m

Slope: Flat to undulating with limited areas of undulating land (A, B), 0–7°

Landform: Floodplains and low terraces.

Rock type: Fine alluvium (Af). Undifferentiated fine-grained alluvium, floodplain alluvium (Af), and fine alluvium intercalated with organic-peat deposits (Af + Pt).

Soils: Recent soils on sedimentary and volcanic alluvium. Recent soils of Whareora suite (WFa, WF, WFa) and Kohumaru suite (MF, MFm). Moderately to strongly leached yellow-brown earths of Whareora suite (WU). Moderately to strongly leached brown granular loams and clays of Kohumaru suite (KM, KMm). Gley soils of Kaipara suite (TZ, TZy, KP, KPy, KA, KAy), Waipapa suite (KO, KOr, KOl, KOy, YF), Waipu suite (YUa, YUay, YU, YUy, YA) included where wetness is considered a severe limitation to arable use.

Erosion: *Present:* Negligible (0) to moderate (2) streambank (Sb). Negligible (0) to slight (1) deposition (D). Some areas may show moderate (2) to severe (3) deposition after floods

Potential: Moderate streambank (Sb) and deposition (D)

Vegetation: Improved pasture (gI), rushes, sedges (hR), wetland vegetation (hW), gorse (sG), manuka, kanuka (sM).

Annual rainfall range: 1200–1600 mm

Land use: *Present:*

Grazing	–	Intensive
	–	Present average carrying capacity (s.u./ha) = 17
	–	Top farmer carrying capacity (s.u./ha) = 20
Cropping	–	Root and green fodder crops

Potential:

Grazing	–	Intensive
	–	Attainable physical potential carrying capacity (s.u./ha) = 24
Cropping	–	Root and green fodder crops
Forestry	–	Production – site index for *Pinus radiata* = 20–23.

Soil conservation management: These areas may be prone to occasional flooding (deposition and erosion). Suitable flood protection such as drainage and stopbanks should be

considered on a long-term basis, management should be directed over whole catchment.

- On-farm drainage required. Maintain condition of drains.
- Stopbanks should be constructed in flood prone areas and their condition maintained.
- Streambank protection may be required. Erosion can be locally severe and difficult and expensive to repair or control.
- Maintain clearance of vegetation within stream and river channels.
- Watertables need to be monitored and controlled.

Comments: Soils may range from well to poorly drained. Much land can be effectively drained, but high watertables, periodic flooding, and runoff from surrounding hills add to the drainage difficulty. Many areas require stopbank protection.

LUC unit: IVs3 (10 407 ha)

LUC suite: 7. Old volcanic terrain

LUC subsuite: 7a. Landforms on old stable basalt–andesite volcanics with brown granular loams and clays:
(LUC units IVe3, IVs3, Vc2, VIe2, VIe16, VIc1, VIIe1)

Description: Flat to gently undulating slopes on old deeply weathered 'basic to intermediate' volcanic rock (e.g. dolerite, andesite) and volcanic alluvium. Rock types recorded in NZLRI include ancient volcanics, In; volcanic breccia, Vb; volcanic alluvium, Uf. Soils brown granular loams and clays. Areas include flat to gently rolling slopes on terraces, plains and high plateaux. Severe soils limitation to arable use due to the low fertility and poor drainage characteristics.

Type location: 004/700853 State Highway 10, near Mangonui

Altitudinal range: 0–600 m

Slope: Flat to undulating (A, B), 0–7°. Includes gently rolling areas (B+C, C+B) >300 m a.s.l. and <600 m a.s.l.

Landform: Flat to gently rolling surfaces on old terraces, plains, uplands or plateaux, rolling downlands.

Rock type: Ancient volcanics (In), unconsolidated clays and silts (Uf), indurated volcanic breccias (Vb), indurated fine-grained pyroclastics (Tb), lavas and welded ignimbrites (Vo), ultramafics (Um).

Soils: Brown granular loams and clays on old volcanic rocks and alluvium. Strongly to very strongly leached brown granular loams and clays of Kohumaru suite (PCr, PC, PCm, PCy, PL), Huia suite (CW, Hl, Hlg), Te Kie suite (RUr, RU, AW, TP), Katui suite (AR). Includes moderately to strongly leached brown granular loams and clays of Katui suite (YP, WT, TO), Huia suite (DV, PA, YT), Te Kie suite (YN, MN). May include some areas of weakly to moderately leached brown granular loams and clays.
Parent materials include volcanic alluvium, shattered dolerites, breccias and tuffs, andesitic agglomerates and breccias and andesitic flows.

Erosion: *Present:* Negligible (0) to slight (1) sheet (Sh) and gully (G)
Potential: Slight (1) gully (G). Slight (1) rill (R) and sheet (Sh) on undulating to rolling slopes when cultivated

Vegetation: Improved pasture (gl), manuka, kanuka (sM), lowland podocarp–broadleaved forest (fO), root and green fodder crops (cR).

Annual rainfall range: 1400–1800 mm

Land use: *Present:*
- Grazing – Intensive
- Grazing – Present average carrying capacity (s.u./ha) = 13
- Grazing – Top farmer carrying capacity (s.u./ha) = 15

Potential:
- Grazing – Intensive
- Grazing – Attainable physical potential carrying capacity (s.u./ha) = 18
- Cropping – Root and green fodder crops. Horticulture.
- Forestry – Production – site index for *Pinus radiata* = 24–27

Soil conservation management:
- When cultivating, contour cultivation and minimum-tillage practices are recommended.

- Soils moderately to strongly leached, and deficient in some nutrients, adequate fertiliser/trace element applications required to counter nutrient deficiencies.
- Maintain good pasture cover and pasture quality.
- Shelterbelts/tree planting recommend for pastoral, cropping and horticultural land uses minimise surficial erosion, maintain soil moisture levels, increase organic matter.
- Irrigation may be necessary, particularly for horticulture.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking). Bare ground difficult to revegetate when topsoil depleted.

Comments: Soils prone to seasonal soil moisture deficiencies, particularly during summer months. At high altitudes (>400 m a.s.l.) soils have particularly poor internal drainage characteristics. Heavy topdressing with phosphate, potash, lime, and trace elements needed to establish and maintain pastures. Exotic conifer forest may be limited at higher elevations by higher rainfalls and poor drainage.

LUC unit: IVs5 (14 885 ha)

LUC suite: 1. Coastal sand country

LUC subsuite: 1c. Old stable podzolised terraces and escarpments on unconsolidated to compact sands:
(LUC units IVe10, IVs5, VIe14, VIs4, VIIe9)

Description: Flat to undulating slopes on coastal terraces, plains and marine benches. Soils are podzols, gley podzols, and podzolised yellow-brown sands on unconsolidated to compact sands and gravels. Soils are generally of very low natural fertility and have poor structure. Extreme limitations for arable use.

Type location: P08/915715 Turkey Flat Road

Altitudinal range: 0–200 m

Slope: Flat to gently rolling (A-C), 0–15°

Landform: Coastal terraces, low-lying dunes, marine benches. Flat to gently rolling slopes on terrace surfaces. A range of terrace heights exists.

Rock type: Unconsolidated sands and gravels (Us).

Soils: Podzols and podzolised yellow-brown earths on coastal sands. Podzols, gley soils and weakly to moderately podzolised yellow-brown earths of Pinaki suite (TEK, TEKy, TX, TXp, TEKm, TT). Podzolised gley soils of Kaikino suite (KK) may be included.

Erosion:
Present: Negligible (0) to slight (1) sheet (Sh), wind (W), gully (G), tunnel gully (T)
Potential: Slight (1) to moderate (2) gully (G), tunnel gully (T) and sheet (Sh) under pasture. Moderate (2) sheet (Sh), wind (W), rill (R) and gully (G) when cultivated

Vegetation: Improved pasture (gl), manuka, kanuka (sM), heath (sH), rushes, sedges (hR).

Annual rainfall range: 1000–1400 mm

Land use:
Present:
Grazing – Intensive
– Present average carrying capacity (s.u./ha) = 13
– Top farmer carrying capacity (s.u./ha) = 15
Undeveloped land
Forestry – Production – exotic spp.
Potential:
Grazing – Attainable physical potential carrying capacity (s.u./ha) = 18
Cropping – Marginal, root and green fodder crops
Forestry – Production – site index for *Pinus radiata* = 20–23

Soil conservation management:
- When cultivating, contour cultivation and minimum-tillage practices essential. In some areas deep ripping required as pretreatment because of hardpans in subsoil.
- Correct siting of drainage channels to prevent initiation of gullies.
- Shelterbelts and tree planting recommended for wind protection, to improve soil structure and increase organic matter in soils.
- Maintain complete vegetative cover and good pasture quality/apply adequate fertiliser–trace-element levels.
- Control grazing by avoiding overstocking and concentrated stock movement (e.g. repeated tracking, particularly near gates, fencelines and around troughs).
- Irrigation important in some areas, particularly for horticulture.

Comments: Podzols have indurated silica, humus and iron pans which cause wide fluctuations in moisture and consequently limit plant growth and farming use. Soils have low nutrient content and require moderate to high applications of lime and plant nutrients to maintain pastures for pastoral farming. Arable use usually requires breaking of subsurface pans.

LUC unit VIe2 (92 605 ha)

LUC suite: 7. Old volcanic terrain

LUC subsuite: 7a. Landforms on old stable basalt–andesite volcanics with brown granular loams and clays:
(LUC units IVe3, IVs3, Vc2, VIe2, VIe16, VIc1, VIIe1)

Description: Strongly rolling to moderately steep slopes forming hilly terrain on old 'basic' to 'intermediate' volcanics, e.g. dolerite, andesite, basalt incl. andesitic–basaltic volcanics, ancient volcanics, volcanic breccias. Soils are brown granular loams and clays. There is a potential for moderate soil slip and sheet erosion.

Type location: 004/644905 Mangonui area

Altitudinal range: 0–800 m

Slope: Strongly rolling to moderately steep (D, E), 16–25°, 0–800 m a.s.l. – includes strongly rolling and rolling slopes (D+C, D), 16–20° above 600 m a.s.l.

Landform: Hill country. Hilly terrain.

Rock type: Ancient volcanics (In), indurated volcanic breccias (Vb), indurated fine-grained pyroclastics (Tb), lavas and welded ignimbrites (Vo), ultramafics (Um).

Soils: Brown granular loam and clay hill soils on old volcanic rocks. Weakly to strongly leached brown granular loams and clays of Te Kie suite (TUH, TWH, AKH, C5H, YNH, MNH, RUrH, RUH) associated with limited areas of BG loams and clays on rolling land (TU, AK, C5, YN, MN, RUr, RU).
Weakly to strongly leached brown granular loams and clays of Huia suite (HUH, BMH, PTH, DVH, PAH, YTH, CWH) associated with limited areas of BG loams and clays on rolling land (HU, BM, DV, PA, YT, CW, Hl, Hlg).
Weakly to strongly leached brown granular loams and clays of Katui suite (KTH, YPH, WTH) associated with limited areas of BG loams and clays on rolling land (KT, YP, WT).
Parent materials include shattered dolerites, breccias and tuffs, andesitic agglomerates, and breccias and andesitic flows.

Erosion: *Present:* Negligible (0) to moderate (2) soil slip (Ss), sheet (Sh), gully (G) and earthslip (Es)

Potential: Moderate (2) soil slip (Ss), sheet (Sh), gully (G), and earthslip (Es). Slight (1) earthflow (Ef). Localised severe (3) soil slip (Ss) and earthslip (Es) can occur under high-intensity rainstorms

Vegetation: Improved pasture (gI), semi-improved pasture (gS), lowland podocarp–broadleaved forest (fO), manuka, kanuka (sM).

Annual rainfall range: 1400–1800 mm

Land use: *Present:*
Grazing – Semi-intensive to intensive
– Present average carrying capacity (s.u./ha) = 7
– Top farmer carrying capacity (s.u./ha) = 8
Forestry – Production – exotic spp.
Undeveloped land

Potential:
Grazing – Attainable physical potential carrying capacity (s.u./ha) = 9
Cropping – Unsuitable
Forestry – Production – site index for *Pinus radiata* = 30–33

Soil conservation management:

Stable hill country, good soil conservation management is essential.

- Maintain good-quality pastures/apply adequate fertiliser levels. Major elements and trace element requirements.
- Open soil conservation trees on areas susceptible to mass movement. Block planting of trees (indigenous scrub and forest) should be considered on steeper slopes and gullies. Forest crops also require topdressing for establishment.
- Maintain complete vegetative cover particularly during drier months. Sheet and wind erosion can be a serious problem and bare-ground areas are difficult to revegetate. Oversow and fertilise slip scars and bare-ground areas.
- Control grazing by avoiding overstocking and concentrated stock movement, particularly in summer months.
- Control runoff.
- Measures required to minimise soil erosion and maintain water quality. Strict management guidelines should be followed when land is prepared for tree planting, road construction, drains and culverts (all earthworks), logging (harvesting), deforestation, scrub clearance.
- Control noxious weeds (tobacco weed) as part of pasture maintenance.

Comments:

Old volcanics often difficult to farm. Generally strongly leached soils with granular topsoils – prone to drying out in summer. Difficult to revegetate eroded areas. Revegetation requires liming to raise pH (i.e. high levels of Fe and Al in subsoil). Fertiliser required:

- heavy initial dressings of phosphate, trace elements;
- lower applications of fertiliser for pasture maintenance;
- avoid loss of phosphate by iron and Al fixation.

LUC unit: VIe6 (13 510 ha)

LUC suite: 1. Coastal sand country

LUC subsuite: 1b. Old stable sand dunes on unconsolidated to compact sands: (LUC units IIIe5, IIIs4, IVe9, VIe6, VIIe9)

Description: Strongly rolling to moderately steep slopes forming rounded hills on old more stable, weathered dunesands. Sands are unconsolidated to compact. Soils are yellow-brown sands. Potential for moderate soil slip, sheet and wind erosion.

Type location: P08/869735 Red Hill – Oturei Road

Altitudinal range: 0–200 m

Slope: Strongly rolling to moderately steep (D, E), 16–25°

Landform: Hilly land, rounded hills (dune hills).

Rock type: Unconsolidated to compact sands (Us) deposited by aeolian processes.

Soils: Yellow-brown sand hill soils on aeolian sand. Moderately weathered, moderately to strongly leached yellow-brown sands of Pinaki suite (HOH, RLaH, RLH, RLIH).

Erosion:
Present: Negligible (0) to moderate (2) sheet (Sh), wind (W), soil slip (Ss). Negligible (0) to slight (1) gully (G)
Potential: Moderate (2) sheet (Sh), wind (W), soil slip (Ss) and gully (G)

Vegetation: Improved pasture (gI), semi-improved pasture (gS), manuka, kanuka (sM), heath (sH), cassinia (SC), exotic conifer forest (fF).

Annual rainfall range: 1000–1400 mm

Land use:
Present:
Grazing – Semi-intensive
– Present average carrying capacity (s.u./ha) = 11
– Top farmer carrying capacity (s.u./ha) = 13
Undeveloped land
Potential:
Grazing – Attainable physical potential carrying capacity (s.u./ha) = 15
Cropping – Unsuitable
Forestry – Production – site index for *Pinus radiata* = 26–29

Soil conservation management:
- Maintain good-quality pastures/apply adequate fertiliser levels – major elements and trace element requirements. Topdress to maintain pastures, oversow with clover.
- Control runoff away from steep slopes and potentially unstable sites. Gullying can occur in drainage depressions.
- To minimise soil erosion and maintain water quality, carefully plan all earthworks and excavation of roads, drains, dams.
- Control grazing by avoiding overstocking and concentrated stock movement. Carefully site fencelines, stock ponds, gates, etc., to avoid repeated tracking. Minimise sheet and wind erosion as bare-ground areas can be difficult to revegetate. Adequate spelling of pastures recommended, particularly in summer months.
- Shelterbelts, windbreaks are recommended.
- Gullies (VIe9) traversing this unit should be retired, fenced off and revegetated. Access roads and tracks should be carefully planned.
- Maintain dense vegetation cover on steeper slopes.

LUC unit: VIe16 (49 091 ha)

LUC suite: 7. Old volcanic terrain

LUC subsuite: 7a. Landforms on old stable basalt–andesite volcanics with brown granular loams and clays:
(LUC units IVe3, IVs3, Vc2, VIe2, VIe16, VIc1, VIIe1)

Description: Moderate to steep slopes forming steep hilly terrain on old 'basic' to 'intermediate' volcanics including andesites, basalts, and dolerites. Soils brown granular loams and clays and related steepland soils. Unit represents steeper version of VIe2. Potential for moderate to severe soil slip and sheet erosion, and for moderate debris avalanche.

Type location: 004/660835 Paroanui

Altitudinal range: ~ 0–800 m

Slope: Moderately steep to steep (E, F), 21–25°

Landform: Hilly to steep hilly terrain.

Rock type: Ancient volcanics (In), lavas and welded ignimbrites (Vo), indurated volcanic breccias (Vb), indurated fine-grained pyroclastics (Tb), conglomerate and breccia of volcanic origin (Cg).

Soils: Brown granular loam and clay hill and steepland soils on old andesite–basalt volcanics. Weakly to strongly leached brown granular loams and clays of Te Kie suite (TUH, TWH, AKH, C5H, YNH, MNH, RUrH, RUH, TES, TEuS, TErS), Huia suite (HUH, BMH, PTH, DVH, PAH, YTH, CWH, HAS, HAlS), and Katui suite (KTH, YPH, WTH).
Parent materials include shattered dolerites, breccias and tuffs, andesitic agglomerates and breccias, and andesitic flows.

Erosion:
Present: Slight (1) to severe (3) sheet (Sh), and soil slip (Ss). Slight (1) to moderate (2) gully (G), earthslip (Es), and debris avalanche (Da)
Potential: Moderate (2) to severe (3) sheet (Sh), soil slip (Ss), and earthslip (Es). Moderate (2) gully (G) and debris avalanche (Da)

Vegetation: Lowland podocarp–broadleaved forest (fO), kauri forest (fK), manuka, kanuka (sM), mixed indigenous scrub with tree fern (sT), mixed indigenous scrub (sX), exotic conifer forest (fF), semi-improved pasture (gS), improved pasture (gI).

Annual rainfall range: 1400–>2000 mm

Land use:
Present: Undeveloped
Grazing – Present average carrying capacity (s.u./ha) = 7
– Top farmer carrying capacity (s.u./ha) = 8
Forestry – Production – exotic spp.
Potential: Grazing – Attainable physical potential carrying capacity (s.u./ha) = 9
Cropping – Unsuitable
Forestry – Production – site index for *Pinus radiata* = 30–33

Soil conservation management:
- Maintain good-quality pasture / apply adequate fertiliser levels – major elements and trace element requirements.
- Open planting of soil conservation trees on areas susceptible to mass movement. Block planting of trees (indigenous forest or exotic forest)

should be considered on steeper slopes and gullies. Forest crops require topdressing for establishment, etc.

- Maintain complete vegetative cover particularly during summer months. Sheet and wind erosion can be serious problem and bare-ground areas are difficult to revegetate. Oversow and fertilise slip scars and bare-ground areas.
- Control grazing by avoiding concentrated stock movement (repeated tracking, along fencelines, tracks).
- Control runoff. Measures required to minimise soil erosion and maintain water quality. Follow strict management guidelines when land is prepared for tree planting, road construction, drains and culverts (all earthworks), logging (harvesting), deforestation, scrub clearance.
- Control feral (noxious) animals in forested areas. Conservation planting must be adequately protected from damage by cattle, goats, possums.

Comments:

Old volcanics often difficult to farm. Generally strongly leached soils with granular topsoils – prone to drying out in summer. Difficult to revegetate eroded areas particularly where slipping or debris avalanche has removed soil down to bedrock. Revegetation requires liming to raise pH (high levels of Fe and Al in subsoil).

Fertiliser required:

1. heavy initial dressings of phosphate, trace elements,
2. lower application of fertiliser for pasture maintenance,
3. avoid loss of phosphate by iron and aluminium fixation.

LUC unit: VIw3 (3251 ha)

LUC suite: 2. Alluvial and estuarine plains and low terraces

LUC subsuite: 2e. Peats:
(LUC units IIIw4, IVw3, VIw3, VIIw2)

Description: Flat to gently undulating land with organic soils on peat and alluvium. Includes low-lying flats, narrow valleys, plains, interdune swamps, etc. Areas on peat often drained and reclaimed but have continuing or prolonged wetness limitation due to flooding or permanently high watertable. Many areas are swampland.

Type location: Q06/pt R06/170214 Otakairangi Road

Altitudinal range: 0–100 m

Slope: Flat to undulating (A), 0–3°

Landform: Low-lying flat land on peat such as plains, swamp-filled valleys, floodplains.

Rock type: Peat (Pt) or peat complexed with fine alluvium (Pt + Af).

Soils: Organic soils of Ruakaka suite (PZ, OT, RK, RKu, RKd, RKy, RKl) and Otonga suite (OG, OGd, OGv, OR, ORd) on peat or peat and sand.

Erosion:
Present: Negligible (0) to slight (1) deposition (D)
Potential: Slight (1) to moderate (2) deposition (D). Slight (1) to moderate (2) streambank (Sb)

Vegetation: Semi-improved pasture (gS), rushes, sedges (hR), manuka, kanuka (sM), wetland vegetation (hW), exotic broadleaved forest (fR).

Annual rainfall range: 1200–1600 mm

Land use:
Present: Undeveloped land
Grazing – Present average carrying capacity (s.u./ha) = 13
– Top farmer carrying capacity (s.u./ha) = 15
Potential:
Grazing – Attainable physical potential carrying capacity (s.u./ha) = 18
Cropping – Unsuitable
Forestry – Production – site index for *Pinus radiata* = <18
– may suit hardwoods

Soil conservation management:
- Areas prone to flooding or have permanently high watertables. Mainly suited to pastoral farming, grazing. Suitable flood protection should be considered on long-term basis, management/planning should be directed over the whole catchment.
- Management of watertable levels required for productive use.
- Stopbanks recommended.
- Drainage planning at the community level required.
- Erosion (stream/river bank and deposition) locally severe, difficult and expensive to repair/control. Bank protection required in some areas (tree planting).
- Avoid disturbance/modification of channels, chanel beds (control aggradation and degradation). Control earthworks adjacent to channels.
- Maintain clearance of vegetation within stream and river channels. Avoid tree felling and deposition of slash, debris in channels.
- Areas often necessary for flood detention and require careful management.

Comments: Areas would be greatly affected by any rise in sea level or base level changes within channels/harbour areas.

LUC unit: VIIw1 (4277 ha)

LUC suite: 2. Alluvial and estuarine plains and low terraces

LUC subsuite: 2c. Poorly drained floodplains and low terraces: (LUC units IVw1, VIw1, VIIw1)

Description: Low-lying, flat areas on floodplains and low terraces (riverflats) with watertables at or near surface. Includes mainly alluvial river flats and swamps with continuing severe wetness limitation and subject to frequent flooding or permanently high watertable. Recent soils, often mottled, on alluvium or alluvium and peat. Represents areas difficult to drain, land used for flood retention, and areas generally of high flood risk.

Type location: P06/036342 Motatau Road

Altitudinal range: 0–100 m

Slope: Flat to undulating (A), 0–3°

Landform: Floodplains, levees, swamps, margins of estuaries.

Rock type: Fine alluvium (Af).

Soils: Recent soils on sedimentary and volcanic alluvium. Recent soils of Whareora suite (WFm, WF, WFa) and Kohumaru suite (MFm, MF). Gley soils of Kaipara, Waipapa, and Waipu suites may be included where wetness is considered severe or prolonged.

Erosion: *Present:* Negligible (0) to slight (1) streambank (Sb) and deposition (D)
Potential: Slight (1) to severe (3) streambank (Sb) and deposition (D)

Vegetation: Wetland vegetation (hW), rushes, sedges (hR), semi-improved pasture (gS), podocarp forest (fP).

Annual rainfall range: 1200–1800 mm

Land use:

Present:	Undeveloped	–	Wetland vegetation, rushes, sedges
Potential:	Undeveloped		
	Grazing	–	Extensive

Soil conservation management: Areas prone to flooding or permanently high watertables. Often inundated by surface water and have swamp vegetation. Management should be considered on long-term basis and planning should take the whole catchment into account. High value ecologically and for catchment protection.

- Flood detention and ponding often required, and should be carefully managed.
- Drainage control needs to be considered as part of district drainage, flood control scheme.
- Stopbanks required, essential in district schemes (Hikurangi swamp).
- Management of watertables should consider implications to surrounding areas.
- Control earthworks, harvesting of forests, adjacent to channels.

LUC unit: VIIw2 (4550 ha)

LUC suite: 2. Alluvial and estuarine plains and low terraces

LUC subsuite: 2e. Peats:
(LUC units IIIw4, IVw3, VIw3, VIIw2)

Description: Peat-filled valleys, plains, and coastal swamps with watertables at or near the surface, areas frequently flooded, have continuing wetness limitation. Peat is strongly acid and very poorly drained. Organic soils typically recorded.

Type location: 004/324985 Kaimaumau Swamp

Altitudinal range: 0–100 m

Slope: Flat to undulating (A), 0–3°

Landform: Floodplains, swamps, backswamps, margins of estuaries.

Rock type: Peat (Pt), Peat and sand complex (Pt+Af).

Soils: Organic soils on peat or peat and sand. Organic soils of Ruakaka suite (PZ, OT, RK, RKu, RKd, RKy, RKv) and Otonga suite (OG, OGd, OGv, OR, ORd).

Erosion: *Present:* Negligible (0) to slight (1) wind (W), sheet (Sh) and gully (G)
Potential: Slight (1) to moderate (2) wind (W), sheet (Sh), and deposition (D). Slight (1) gully (G)

Vegetation: Wetland vegetation (hW), gorse (sG), manuka, kanuka (sM), heath (sH), semi-improved pasture (gS).

Annual rainfall range: 1200–1600 mm

Land use: *Present:* Undeveloped – Wetland vegetation, rushes, sedges, manuka, kanuka
Grazing – Extensive
Potential: Undeveloped
Grazing

Soil conservation management: Areas prone to flooding or permanently high watertables. Often inundated by surface water and have swamp vegetation. Long-term management should be considered and planning should take the whole catchment into account. High value ecologically and for catchment protection.

- Flood detention and ponding often required, and should be carefully managed.
- Drainage control needs to be considered as part of district drainage, flood control scheme.
- Stopbanks required.
- Management of watertables should consider implications to surrounding areas.
- Control earthworks, harvesting of forests, adjacent to channels.

8.0 REFERENCES

[2024] NZEnvC 083 Blue Glass Limited v Dunedin City Council

Grealish G. 2019. New Zealand soil mapping protocols and guidelines. Manaaki Whenua – Landcare Research.

Harmsworth, G.R. 1996. Land Use Capability classification of the Northland region. A report to accompany the second edition (1:50,000) NZLRI worksheets. Landcare Research Science Series 9. Lincoln, Manaaki Whenua Press.

Hewitt A, Lilburne L 2003. Effects of scale on the information content of soil maps. NZ Soil News 51: 78-81

Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF 2009. NZ Land Use Capability Survey Handbook – a New Zealand handbook for the classification of land 3rd Edition. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science.

Hanmore
Land Management

s 9(2)(a)

hanmorelandmanagement.co.nz